Sharing the Challenge? An Economist's View

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In the aftermath of the Great Flood of 1993, the Clinton Administration commissioned a review of floodplain management in the United States, with an emphasis on the Upper Mississippi. *Sharing the Challenge* is the fruit of that endeavor. This report proposes a new vision for floodplain management and makes numerous specific proposals--31 general recommendations and 52 action items--for implementing that vision. An economic analysis of these proposals suggests some positive achievements and some major shortcomings.

On the positive side, the report highlights some important ideas on floodplain management that have not received sufficient recognition, particularly among operating agencies. Included in those ideas are: (1) A recognition that we cannot *eliminate* the risk of catastrophic flooding and thus that floodplain management must take into account residual risk; (2) a recognition that states, local governments, and private individuals and entities must bear greater responsibility for floodplain management, including greater fiscal responsibility; and (3) a recognition that ecological and other natural values must be incorporated into floodplain management, both in terms of potential for flood water retention and for their own sakes.

On the negative side, the report is marred by fuzzy thinking about these issues and about their implications for policy at the Federal, state, and local levels. The most serious shortcomings involve failures to understand that: (1) floodplain management involves balancing benefits and costs and should thus not involve specific guarantees of safety; (2) environmental concerns are best addressed by including monetary estimates of resource values into benefit-cost analyses; (3) planning is likely to be counterproductive when the incentive structure created by current Federal policies promotes excessive floodplain development; and (4) reasons for Federal involvement in floodplain management are not necessarily reasons for Federal subsidization.

Economically Efficient Flood Risk Management

The goal of floodplain management should be to find the appropriate balance between competing alternative uses of floodplain/river systems**.** Flood plain management involves both land and water resources that have multiple competing uses, including navigation, recreation, commercial fishing, drinking water, wildlife habitat, waste disposal, industry, commerce, human habitation, agriculture, and wildlife habitat. These uses generally compete at the margin, in the sense that increasing the level of one type of use (e.g., wildlife habitat) means decreasing the level of another (e.g., agriculture). Thus, both land and water resources are scarce relative to desired human uses, that is, they are economic goods.

Scarce resources like these should be allocated in a way that gives maximum satisfaction of human wants given the scarcity of the resources available to satisfy those wants. This means choosing a set of multiple uses--including environmental as well as commercial or other human activities--to maximize the net benefits of floodplain use, i.e., total benefits of the services provided by all multiple uses minus the total costs of providing those services. Such a maximum is achieved when the additional social benefit provided by the last unit of each type of service or use equals the additional social cost of providing that last unit.

Human behavior is a critically important factor in floodplain management. The probability of flooding and the potential social and economic damage from flooding depend on land use decisions and thus on economic and institutional factors such as government policies. The phenomenon of *moral hazard* is of particular importance in this regard. An example of moral hazard is when levee construction induces greater floodplain development, which increases damage in the event of flooding and thus at least partially counteracts the decrease in the likelihood of flooding due to the levee. The fact that flood damage continues to rise over time despite increased investment in flood control structures (Federal Interagency Floodplain Management Task Force, chapter 3) suggests that this sort of moral hazard is a significant problem in floodplain management, and thus must be taken into account in determining the appropriate balance among competing uses of floodplain/river systems. The fact that there are presently 10 million homes in the 100-year flood plain and cases like Chesterfield, Missouri, where an industrial park was sited behind an agricultural levee only to suffer extensive damage during the Great Flood, are frequently cited in this regard (see for example Faber and Hunt).

Several implications about floodplain management follow from this general economic perspective. First, *Sharing the Challenge* is right in pointing out that absolute safety neither can nor should be guaranteed, but is inaccurate in calling for "reduc[ing] the vulnerability of the nation to the dangers and damages that result from floods." Reducing expected flood damage should not be a goal of flood plain management *per se*; rather, the appropriate level of protection from flooding should equate the marginal social

benefits of expected damage reduction with its marginal social cost. High expected flood damage may well be appropriate if the expected benefits of an activity are large enough to outweigh expected damage, but not large enough to justify further investment in protection. *Eliminating* the risk of flooding and/or flood damage is generally *not* desirable because the marginal cost of providing complete protection from flooding typically exceeds the marginal benefits. For example, the risk of flood damage can be eliminated completely by simply restricting any human use of flood-prone areas, but this hardly seems reasonable: Economic activity in floodplains is valuable enough that the social costs of such a policy (the value of foregone uses of the floodplain) will generally far exceed the social benefits of reduced flood damages incurred over time.

Second, over time, some flood losses are certain to occur, even under an optimal policy. Moreover, it is not likely that an optimal flood management policy would permit rare but severe flooding (because of the high marginal costs and low *expected* (i.e., average annual) benefits of containing rare, extremely high flood stages), so that this year's massive flooding along the Mississippi does not demonstrate in and of itself that the current level of flood protection is insufficient. To its credit, *Sharing the Challenge* explicitly recognizes that the experiences of the Great Flood of 1993 demonstrate how *well* the current flood protection system works. The damage estimates provided by the report suggest that the expected losses from events like the Great Flood are probably not large enough to warrant greater protection: Deducting losses occurring outside the floodplain and losses due to disrupted barge traffic from the report's total of $12 billion, putting crop losses on an income basis using a (generous) rate of return of 15 percent, assuming an average value of $1000 per acre for the 60,000 acres of farm land rendered unusable, and using a frequency of return of 0.2 percent gives expected annual damage on the order of only $8 to $10 million.

Third, the concept of the Standard Project Flood (SPF) should have little or no place in floodplain management. Instead, the level of protection for every location should equate marginal social benefit with marginal social cost, including external costs of protection in terms of increased flood risk and/or damage in the event of flooding elsewhere in the floodplain. However, *Sharing the Challenge* recommends protecting "population centers" and "critical infrastructure" from SPF discharges, where SPF is defined as the 0.2-percent annual chance flood (p. 70). Use of an SPF criterion can be especially harmful because of moral hazard effects: Those protected by levees built to an SPF standard will assume that they are subject only to a negligible residual flood risk, and will develop land behind those levees accordingly, increasing damage in those rare events of greater-than-SPF magnitude. Moreover, establishing a criterion like SPF-level protection for "population centers" is an open invitation for developers to recreate the Chesterfield situation by creating "facts on the ground", then demanding greater levels of protection.

Preserving and Enhancing the Natural Resources and Functions of Floodplains

Many of the services provided by land and water resources are economic goods, even if they are not explicitly bought and sold like other commodities. Recreation (swimming, boating, fishing, scenic amenities, wildlife habitat), water quality improvements provided by wetlands, flood water retention from natural areas, and other environmental services have value because they are scarce relative to desired human uses. The existence of certain species or types of habitat may similarly have value because of their scarcity relative to the
levels desired.

Economically efficient floodplain management must take the costs and benefits of these natural goods and services into account in a more thorough and comprehensive way than has been the case to date. To its credit, *Sharing the Challenge* recognizes the importance of doing so and makes a number of recommendations aimed at making environmental considerations more central to floodplain management. These include: establishing environmental quality as a co-equal objective with national economic development; giving greater consideration to nonstructural flood protection measures, including restoration of natural wetlands, flood water retention areas, and floodways; giving the Interior Department a greater role in floodplain management decisions; and ensuring greater coordination and commonality of guidelines for habitat and wetlands restoration buyouts during the aftermath of floods, when buyouts are more politically and fiscally feasible.

Operationally, *Sharing the Challenge* proposes to make environmental concerns central to floodplain management decision making by replacing the current Principles and Guidelines (P&G) used by the Army Corps of Engineers for project evaluation with a system of accounts that would report (1) national economic development (national income), (2) regional economic development, (3) other social effects, and (4) environmental quality.

This proposal is problematic because it puts measures pertaining to the efficient use of resources, or national income broadly defined, on a par with measures pertaining to the distribution of resources, that is, it confuses efficiency and equity. Environmental quality is a component of national income (or national economic development, in the Army Corps' terminology), and improvements in environmental quality are thus increases in national income. But promoting regional economic development or boosting local employment does *not* increase national income; rather, Federal investment in one region comes at the expense of other regions, so that regional development generally

involves only the distribution of income. The system-of-accounts proposal is especially worrisome because it could be used to justify economically inefficient projects on the grounds of regional economic development or other effects. Doing so could ultimately have negative effects on environmental quality by broadening the range of acceptable Corps projects.

A straightforward alternative is to incorporate monetary estimates of the values of environmental services into benefit-cost analyses of floodplain management options. Doing so is certainly feasible: There has been tremendous progress in the development of methods for valuing these goods and services monetarily, both in cases where they affect market transactions and in cases where they do not. The value of reductions in flood risk due to flood water retention can be estimated from reductions in the cost of protection downstream, the value of improved water quality of wetlands from the reduction in water treatment costs or improved recreational opportunities. The value of improved recreational opportunities can be estimated from market transactions using revealed preference methods such as travel-cost models, hedonic property value models, and other methods for deriving environmental values implicit in observed market transactions. The values of environmental amenities can be estimated from contingent valuation methods, which, despite some controversies over finer methodological points, are widely recognized. (see for example Arrow et al.).

Organizing Floodplain Management for Success?

The main message of *Sharing the Challenge* is that the best way to improve floodplain management is through more comprehensive and better-coordinated planning.

The report calls for the creation of a set of interlocking institutions at the Federal, state and local levels to coordinate and systematize planning processes. The Water Resources Council would be reactivated to ensure greater cooperation among Federal agencies in floodplain planning. Greater participation by states in floodplain planning would be accomplished through: a Floodplain Management Act that would define responsibilities at different levels of government, strengthen Federal-state coordination, and assure accountability; Federal-state River Basin Commissions (RBCs), which would provide opportunities for discussion and coordination; and the establishment of an Upper Mississippi Rivers and Tributaries (UMR&T) Project, which would institutionalize a planning and management capability for the Upper Mississippi within the Army Engineers.

This view is at best naive. The most comprehensive, best-coordinated, soundest, most objective planning can accomplish very little if the incentives created by economic institutions like markets and government programs induce homeowners, businesses, and governmental bodies to act in ways contrary to the social good. And the incentives operating in floodplains are strikingly perverse, largely because Federal post-disaster assistance creates powerful incentives for excessive floodplain development by ensuring that those investing in floodplain development never bear the full cost of their actions. . Homeowners struck by catastrophic flooding are eligible for grants and for Small Business Administration (SBA) loans at below-market interest rates to rebuild their homes or pay off their mortgages. Businesses--frequently even those of substantial size--also typically receive subsidized SBA loans. Until the reform of crop insurance passed by Congress earlier this year, farmers were compensated for the value of crop losses; even after reform, crop insurance remains heavily subsidized. Local governments get Federal public assistance grants to rebuild damaged public buildings and infrastructure. As a result, individuals and businesses never bear the full cost of locating in floodplains, while local governments--which have authority over land use, building codes, and other essentials of floodplain management--need never be accountable either for succumbing to pressure from local real estate interests by permitting floodplain development or for locating public buildings or infrastructure in high flood-hazard areas.

The moral hazard problem is compounded by the fact that the Federal government subsidizes a large share of the costs of structural flood protection (e.g., levee construction) undertaken under the auspices of the Army Corps of Engineers and of the Soil Conservation Service. Cost-sharing of levees creates a bias favoring structural flood protection measures and, as a consequence, may help promote excessive development of floodplains, most likely with negative effects on environmental quality.

Under these circumstances, the action program proposed by *Sharing the Challenge* is more likely to make matters worse than better. Giving state and local governments a larger voice in the planning process without a corresponding financial stake is an open invitation to demand more Federal largesse. The RBCs and the UMR&T Project provide organizational structures and resources that can be used to justify and lobby for greater development of floodplains and/or greater Federal investment in additional protective measures. The UMR&T Project provides a structure that can be used to capture funding for greater Federal investment in flood protection, i.e., a conduit for pork-barrel spending.

Sharing the Challenge at least partially recognizes the problematic role of Federal post-disaster aid, and proposes some reforms aimed at curbing the worst excesses, such as capping Federal cost-sharing at the current statutory minimum of 75 percent, and giving local governments loans for infrastructure upgrade, removing the temptation to use post-disaster aid for this purpose. But these actions are

nowhere near thoroughgoing enough to remove the perverse incentives created by Federal assistance and mitigate the moral hazard problem to any significant extent. A more effective approach would be to (1) eliminate grants to local governments for public buildings and infrastructure damaged in catastrophes, replacing them with loans at interest rates at least equal to the Federal cost of funds, (2) provide loans to homeowners and businesses at the market rate of interest, and (3) limit the provision of Federal grants to individuals only to the very poor.

Using Flood Insurance to Internalize the Costs of Floodplain Development

Greater reliance on insurance would also help limit moral hazard problems by forcing individuals, businesses, and local governments to face up to the costs of locating in floodplains. *Sharing the Challenge* recognizes this and identifies as a major problem the fact that that most homeowners with property in the 100-year floodplain do not purchase flood insurance, even though they are legally required to do so, while many businesses and local governments remain uninsured as well. The report recommends a number of actions aimed at remedying this state of affairs, including having states encourage flood insurance purchases; improving lender compliance through pending legislation; permitting escrow of flood insurance premiums; developing improved marketing techniques; reducing the amounts of post-disaster aid available for those failing to purchase insurance; and requiring actuarially-based flood insurance for properties behind levees providing less-than-SPF-level protection.

But the report fails to underscore fully enough the fact that Federal post-disaster aid creates enormous disincentives against purchasing insurance because it essentially provides insurance for free. Limiting post-disaster aid to market-rate loans would make insurance far more attractive financially, and is thus likely to be far more effective in promoting insurance purchases than any amount of improved marketing. The report also fails to recognize that Federal post-disaster aid removes any incentives for lenders to enforce the flood-insurance-purchase requirement. Subsidized SBA loans effectively provide lenders with mortgage insurance, making flood insurance redundant from the lender's point of view. Making those without flood insurance ineligible for SBA loans would give lenders an incentive to enforce the purchase requirement, and is likely to be both cheaper and more effective than attempting to accomplish the same end through more strenuous enforcement, as suggested by the report.

It has long been believed that homeowners fail to purchase insurance against catastrophic risks like flooding because they underestimate their likelihood (see for example Kunreuther and White). But experience of floods is more common than the recurrence interval might suggest at first glance, indicating that faulty perceptions of risk may be less of a problem than commonly thought. The probability that at least one flood of 0.2-percent-recurrence magnitude will occur at a given site during the 30-year lifetime of a mortgage, for example, is over 6 percent, while the probability that such a flood will occur over a 50-year period is almost 10 percent. Moreover, as long as flood events in nearby areas are less-than-perfectly correlated, the probability that a flood of such magnitude will occur somewhere nearby is even higher. In fact, there have been numerous floods of 1-percent-recurrence magnitude or higher along the Upper Mississippi over the past 50 years. One suspects that the inhabitants of the Upper Mississippi floodplain experience flooding with as much frequency as most people experience fires, which *are* commonly insured against.

What Role for the Federal Government?

Finally, there is a broader, more fundamental question that *Sharing the Challenge* completely fails to address--that of federalism, that is, what roles the Federal, state, and local governments should play. The current situation has some unusual features. Floodplain management is a form of land use control, a function of government that, in the United States, is under the jurisdiction of local authorities, with some oversight at the state level; the Federal government plays a role in land use planning only in a restricted set of cases where some broader national interest is at stake, for instance, interstate transportation or, more recently, environmental concerns of national scope (beach erosion, wetlands conversion). The fact that floodplain management involves the Federal government directly with local authorities is also unusual, since Federal involvement is typically mediated through state agencies.

Is there a compelling set of national interests that justifies Federal involvement in floodplain management? Or, in economic terms, are there failures of private markets that necessitate Federal intervention to achieve economic efficiency? There are some obvious ones. Flood protection measures at different sites along the Mississippi are interdependent: Flood control and drainage structures at any one site increase the volume and speed of flows on the opposite shore, at sites downstream, possibly at sites upstream, and thus affect the likelihood and severity of flooding. Coordination across the river basin is needed to ensure that these external effects are taken into account in flood protection investment decisions. Federal involvement helps ensure that all states participate in such coordination. Navigation also raises important issues of interstate commerce, in which the Federal government has long maintained a vital interest. Protection of ecosystems and species of national importance further justifies Federal involvement.

But a need for Federal help in *coordinating* flood protection and navigation does not imply a corresponding

need for Federal *subsidization* of these activities, nor does it imply a need for Federal disaster relief. The prospect of moral hazard indicates precisely the contrary: those choosing to locate in floodplains should bear the full cost of their decisions, either by purchasing insurance at actuarially fair rates, or by suffering losses in the event of flooding, so that all development in floodplains can pass a benefit-cost test.

One can argue that capital market imperfections justify a Federal presence: Municipalities and local levee districts may find it difficult to raise funding for justifiable investments in flood protection, for example, while individuals and businesses may find it difficult to raise money for rebuilding, even if they self-insure adequately. But problems of capital *availability* do not imply a need for subsidies: They can be addressed quite adequately by a Federal lending program offering funding at nonsubsidized interest rates.

Alternatively, lack of availability of insurance might be used to motivate a Federal presence. Catastrophic flood risks are not as insurable as fire, for instance; loss provisions cannot be estimated using actuarial methods, and risks must be pooled across time, making it difficult for regulators to determine appropriate premiums. Again, lack of availability may justify Federal involvement, but not subsidization. Affordability problems *may* justify subsidization: Many of those living in floodplains are poor, and cannot afford insurance. If it is believed to be in the social interest to transfer income from the general taxpaying public to the poor living in floodplains, then some subsidization could be warranted; but not subsidization of those with high enough incomes to afford insurance and thus bear the full cost of their locational choices. A disaster relief program designed with affordability in mind would thus feature means-testing of benefits, something current Federal policy does not do. Moreover, one needs to question the wisdom of helping the poor remain in harm's way, rather than encouraging them to move to safer ground.

Sharing the Challenge does not grapple with these fundamental issues. The report could have provided a clearer, more compelling vision of floodplain management of the future had it faced them squarely. Instead, it simply took the existing Federal-state-local division of responsibilities as a given and, as a result, produced a set of recommendations that effectively sidestep arguably the most important challenges of floodplain management as the 21st century approaches.

References

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